Space Weather Technical Forecast

Issued on Friday, 19 November 2021 at 00:31 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms this weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low over the last 24 hours, with no significant X-ray flare activity observed at GOES 16. There are two active sunspot regions on the visible disc: AR2896 and AR2897, which are both small and stable unipolar Hsx/Alpha regions located in the eastern hemisphere.

No Earth-directed Coronal Mass Ejections (CMEs) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind parameters indicate a very gradual exit from the high speed stream of coronal hole 19. The solar wind speed, as measured by DSCOVR and ACE at L1, started the period at elevated levels ranging between 520-540 km/s, then gradually declined to end the day at slightly elevated levels around 490 km/s. The solar wind density remained at average levels, while the IMF was stable between 2-5nT. The phi angle was predominantly negative (towards the Sun) throughout the 24 hours. The north-south component was positive or only very weakly negative. Therefore, despite the strength of the solar wind, geomagnetic activity was Quiet (Kp 0-2) throughout.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 remained at Background levels.

The high energy electron flux (greater than 2 MeV) was predominantly at Moderate levels, peaking at 365 pfu at 18/1940 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), with a steady trend, reaching 8.69e6 integrated pfu at 19/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low, with a Slight Chance of C-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the current forecast. The coronal hole forecast comprises of a continuing slow decline from the current HSS from CH19; before the next high speed stream arrives, this time from CH20. Geomagnetic activity is expected to be Quiet (Kp 0-2) today and for much of tomorrow (20th Nov), before increasing predominantly Unsettled to Active (Kp 3-4) from late tomorrow, with a chance of G1/Minor (Kp 5) geomagnetic storms thereafter.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at Background levels.

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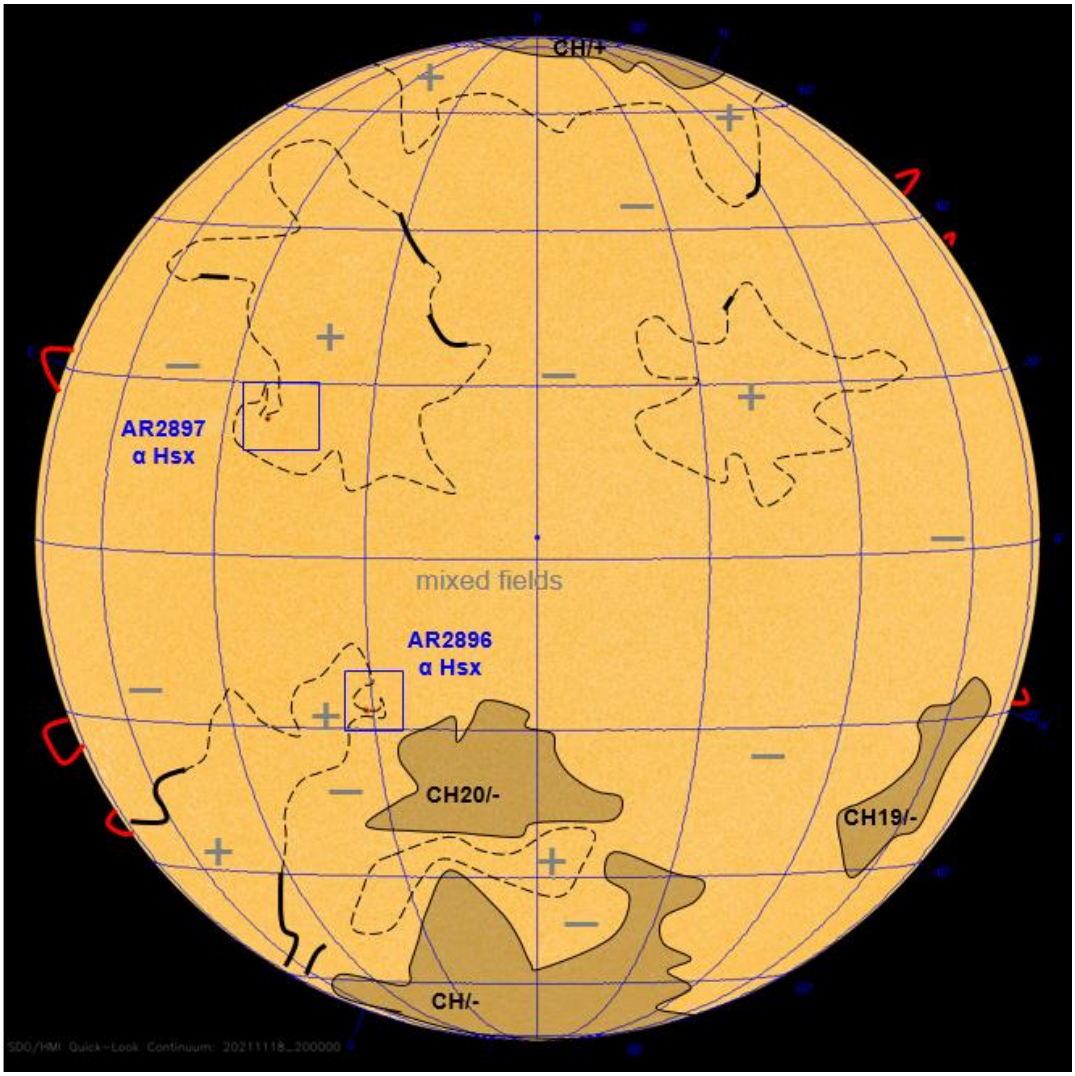
The high energy electron flux (greater than 2 MeV) has not reached High (1000 pfu) levels, despite days of strong or elevated solar winds. Therefore it is now considered that the high energy electron flux is unlikely to exceed the High threshold today or tomorrow, but is likely to breach the High threshold after the next HSS arrives, probably during day 4 (22nd). The corresponding fluence is likely to have an increasing trend, whilst remaining below the Active (1e8 integrated flux).

Figure 1. Solar Analysis Valid 18/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

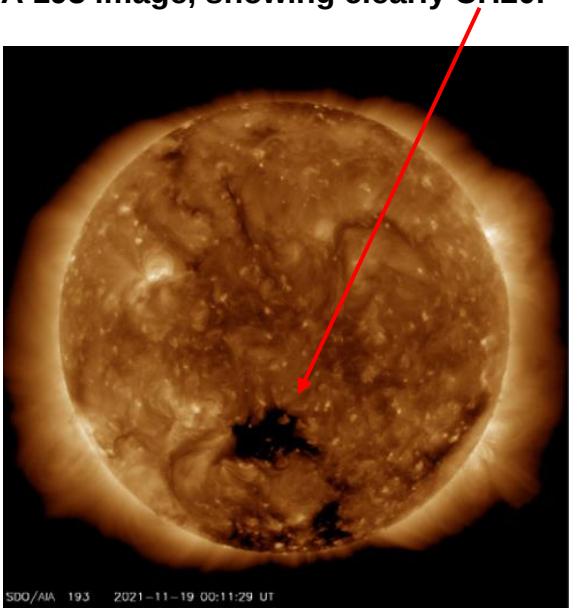
There are no Earth-directed CMEs that feature in the current forecast.
The coronal hole forecast comprises of a continuing slow decline from the current HSS from CH19; before the next high speed stream arrives, this time from CH20.

Currently, using a compromise between STEREO A measurements and Enlil, an onset of the HSS from CH20 is expected within the UTC day of Saturday 20 November, most likely later in the day. Looking at the STREO A data strong speeds with speeds between 600-750km/s are possible. Therefore, despite approaching the semi-annual minimum in coronal hole potency, there remains a Chance of G1, probably peaking as the feature matures into Sunday 21 November.

Geomagnetic activity is expected to be Quiet (Kp 0-2) today and for much of tomorrow (20th Nov), before increasing predominantly Unsettled to Active (Kp 3-4) from late tomorrow, with a chance of G1/Minor (Kp 5) geomagnetic storms thereafter.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	30	40	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Latest SDO/AIA 193 image, showing clearly CH20.



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Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

There are currently two active sunspot regions on the visible disc; AR2896 and AR2897. Both are simple, stable and unipolar spots.

Neither region will rotate off the visible disc during the forecast period. There are various returning Carrington locations lying near or on the eastern limb at present. Despite this, STEREO A EUVI imagery does not indicate that any significant regions will arrive from the farside through the period. Therefore Very Low solar activity is forecast, with a slight chance (10%) of C-class flares.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at Background levels during the previous 24 hours, and is currently forecast to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

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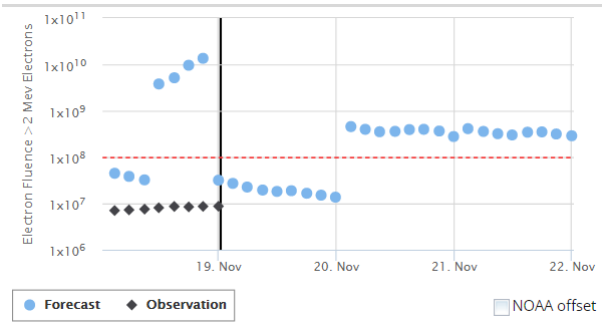
The Met Office REFM model shows the fluence remaining below the Active threshold during day one, but then increases the fluence to above Active for days 2 and 3. This is considered to be initially good guidance, before then declining in usefulness.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	20	30	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	5

Figure 3: Latest Met Office REFM model.



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